Program 3 : Community-Based Landslide Disaster Reduction in Developing Countries

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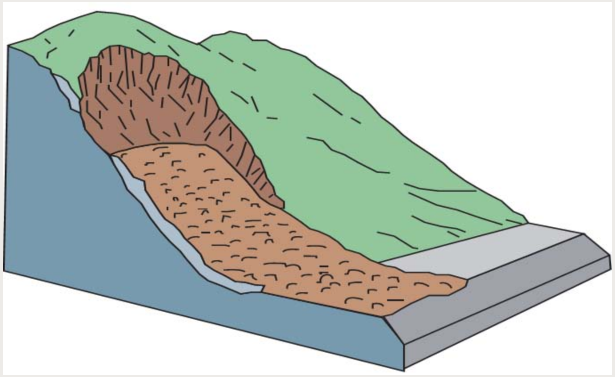
PROGRAM 3

Community - Based Landslide Disaster Reduction in Developing Countries

Proposer Informartion		**Dang Quang Khang** PhD student of Civil and Earth Resources Engineering, Kyoto University, Japan Tel: 080-4010-1628
Aims of Education/training		Knowledge, Actions
Target User	Type	Self learning, Education/training
	Direct user	School teachers, Community leaders, Students
	Trainee/ Indirect User	Students (Elementray school, Junior high school, High school, College/University), Local regidents
Focus of this Information		Process Technology (PT)
Hazards		Landslide
Type of Education/training		Training Camp, Group discussion, Field trip, Self learning
Media/Material		Presentation, Guideline
References		1. DRH 56 - Low-cost and adaptive technology to support a community-based landslide early warning system in developing countries 2. DRH 61 - rain-induced landslide susceptibility: a guidebook for communities & non-experts 3. The Landslide Handbook—A Guide to Understanding Landslides, Lynn M. Highland, United States Geological Survey, and Peter Bobrowsky, Geological Survey of Canada

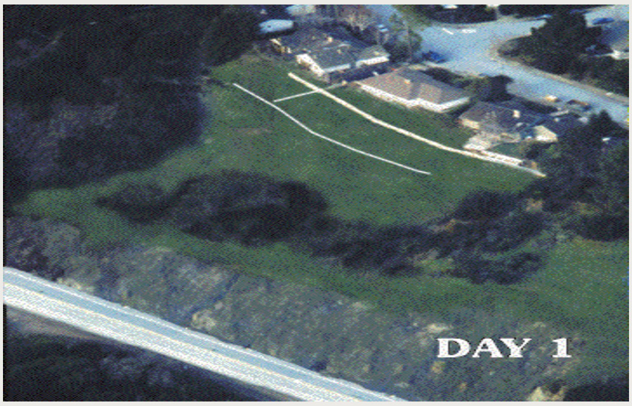


Lecture Contents

Step 1 - Basic Information about Landslides

What is a Landslide?

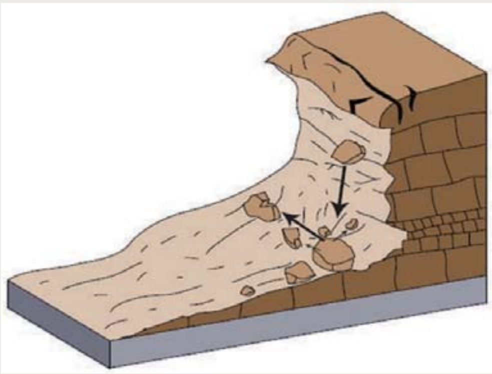
A landslide is the movement of a mass of rock, earth, or debris down a slope



An animated picture of landslide

Landslide that occurred at La Conchita, California, USA in 2005

Basic Landslide Types

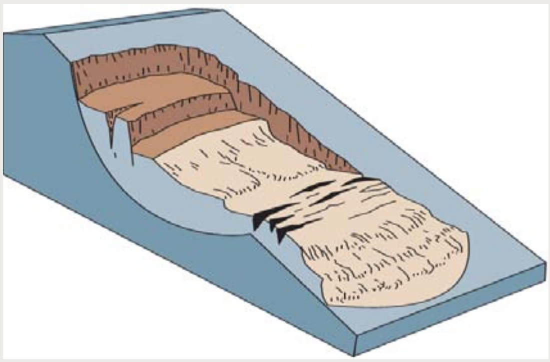


An animated picture of landslide

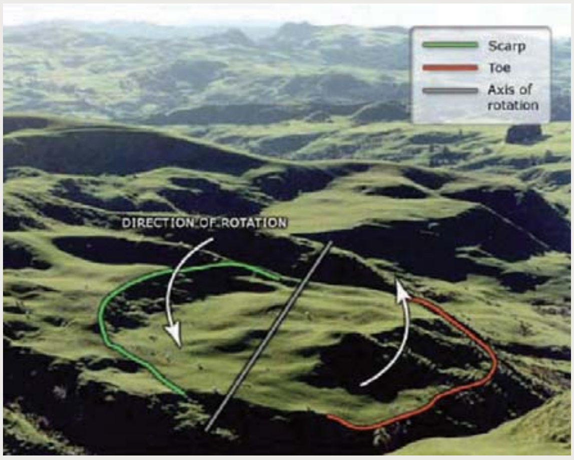
A rockfall that occurred in Clear Creek Canyon, Colorado, USA 2005

Topple

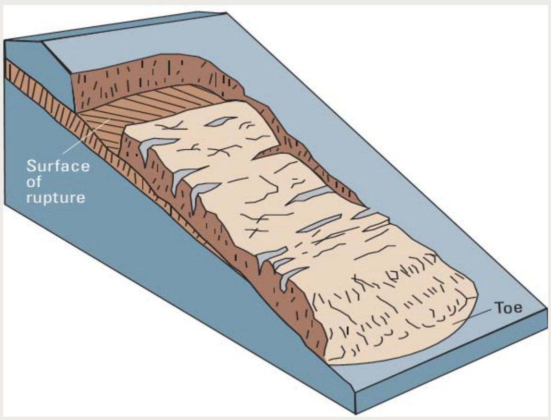
Block toppling at Fort St. John, British Columbia, Canada



Rotational landslide

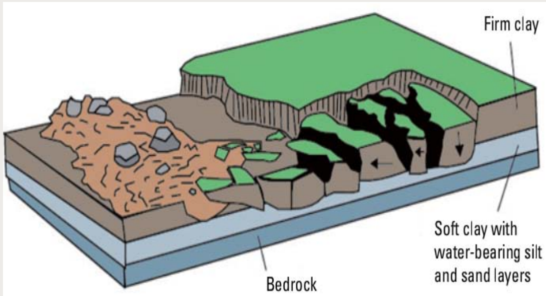


Rotational landslide in New Zealand (Michael J. Crozier, September 21, 2007)



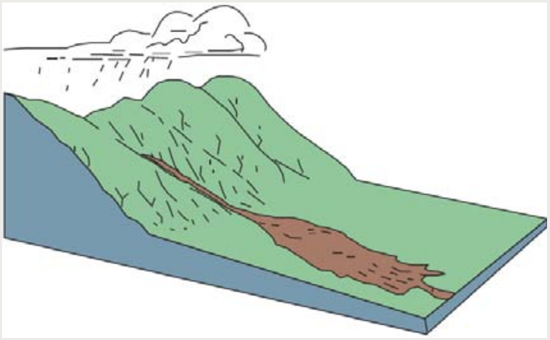
Translational landslide

A translational landslide in 2001 in British Columbia, Canada



Spread

Lateral spread in 1989 in Loma Prieta, California, USA (Steve Ellen, U.S. Geological Survey)

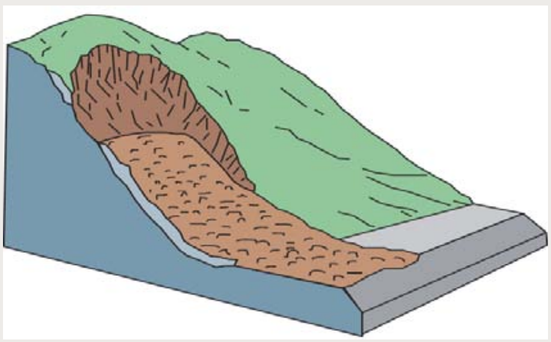


Debris flow

Debris flow on the north coast of Venezuela in December 1999, killing 30,000 people

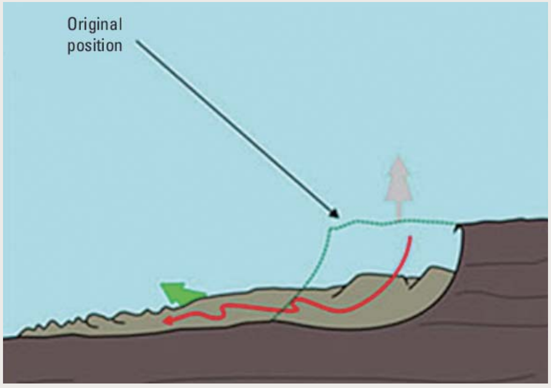
Lahars (Volcanic debris flows)

A lahar in 1982 from Mount St. Helens, Washington, USA



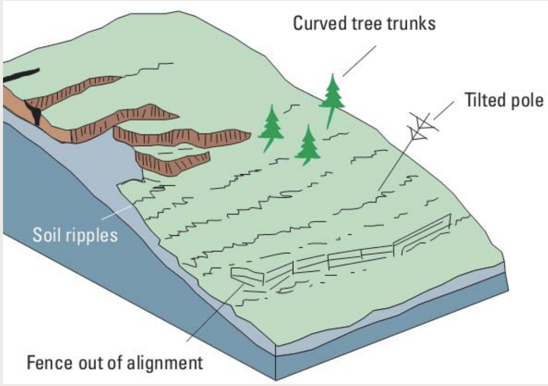
Debris avalanche

A debris avalanche in the Philippines in February 2006



Spread

The 1993 Lemieux landslide – a rapid earthflow in sensitive marine clay near Ottawa, Canada



Slow earthflow (creep)

Creep in United Kingdom
(Photograph by Ian Alexander)

Where do Landslides Occur?

Anywhere in the world:

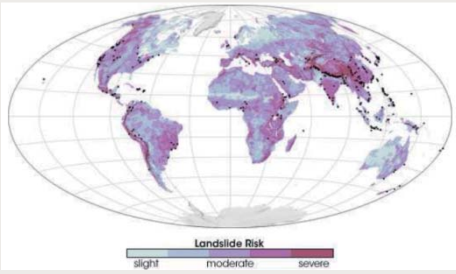
+ On land and under water;

+ Bedrock or soils;

+ Cultivated land, barren slopes, and natural forests

+ Extremely dry areas and very humid areas

+ Steep slopes or gentle slopes (1–2 degrees)

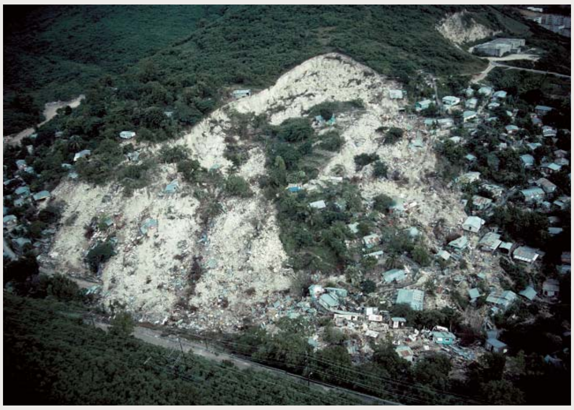


Map of the global risk of landslides (Robert Adler and Yang Hong)

Example of lateral spreading, a type of ground failure often associated with earthquakes

What Causes Landslides?

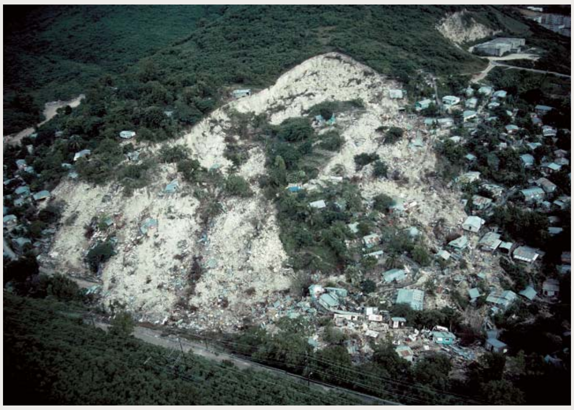
- Natural occurrences:
+ Water: rainfall, snowmelt, changes in groundwater levels
+ Seismic activity: earthquakes
+ Volcanic activity



The Mameyes, Puerto Rico landslide in 1985, triggered by a tropical storm
(Randall Jibson, U.S. Geological Survey)

Earthquake-induced landslide after the 2004 Niigata Prefecture Earthquake
(Professor Kamai, Kyoto University, Japan)

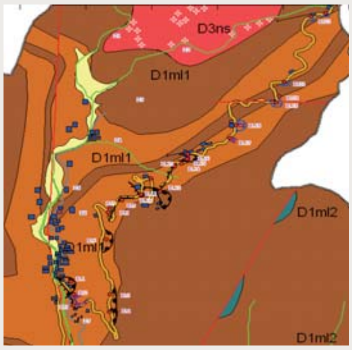
- Human activities:
+ Populations expanding onto new land: Disturbing or changing drainage patterns, destabilizing slopes, and removing vegetation
+ Undercutting the bottom and loading the top of a slope
+ Irrigation, lawn watering, draining of reservoirs, leaking pipes, and improper excavating or grading on slopes.



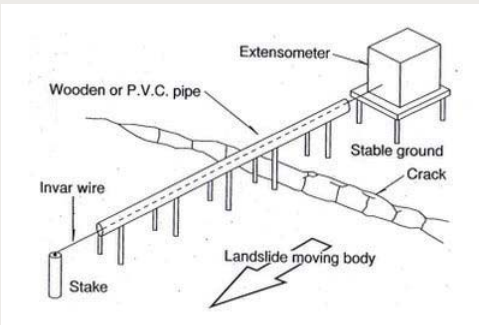
Example of landslides due to human activities

Step 2 - Making a Landslide Hazard Map

- Start with community knowledge
- Conduct field investigation
- Produce a landslide hazard map



Step 3 - Low Cost Early Warning System (DRH 56)



- Proposer: Assoc. Dr. Teuku Faisal Fathani, Gadjah Mada University, INDONESIA

- Saved 35 families from a landslide that occurred in Kalitelaga village in Banjarnegera Regency on November 7, 2007

- These monitoring equipment are connected to a siren system in order to directly warn the local community.

- The local community in remote areas can easily operate and maintain the equipment based on their own capability.

- - Two types of simple extensometers and automatic rain gauge
- + A handmade manual reading extensometer
+ Automatic extensometer, where the relative movement between two points is mechanically enlarged by 5 times and recorded on a paper continually

- Both types of extensometers are connected to the siren system in order to directly warn the local community for taking necessary actions in dealing with landslide disaster.

- A simple modified rain gauge was also developed with hourly rainfall intensity recorded on a paper continually.
- This rain gauge is also connected to the siren system to warn the community when the precipitation reaches a certain value.

- This system presents the results of real-time measurement by using automatic extensometer, tiltmeter, groundwater measurement, and tipping bucket rain gauge

- The monitoring equipment connected with a data logger and integrated in a fieldserver

- This sensing device provides real-time online data display system, which gathers the data from multiple sensors and shows them in a webserver.

- This unit also implements early warning that can be adjusted depending on the site condition.

Step 4 - Implementation

- Task Force for Disaster Mitigation and Management of local community:

+ installation

+ operation

+ maintenance of the technical system

- All the equipment are run by a dry battery and/or solar energy

- Public education and evacuation drill

+ Training for operator

+ Evacuation drills involving primary school students

References

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